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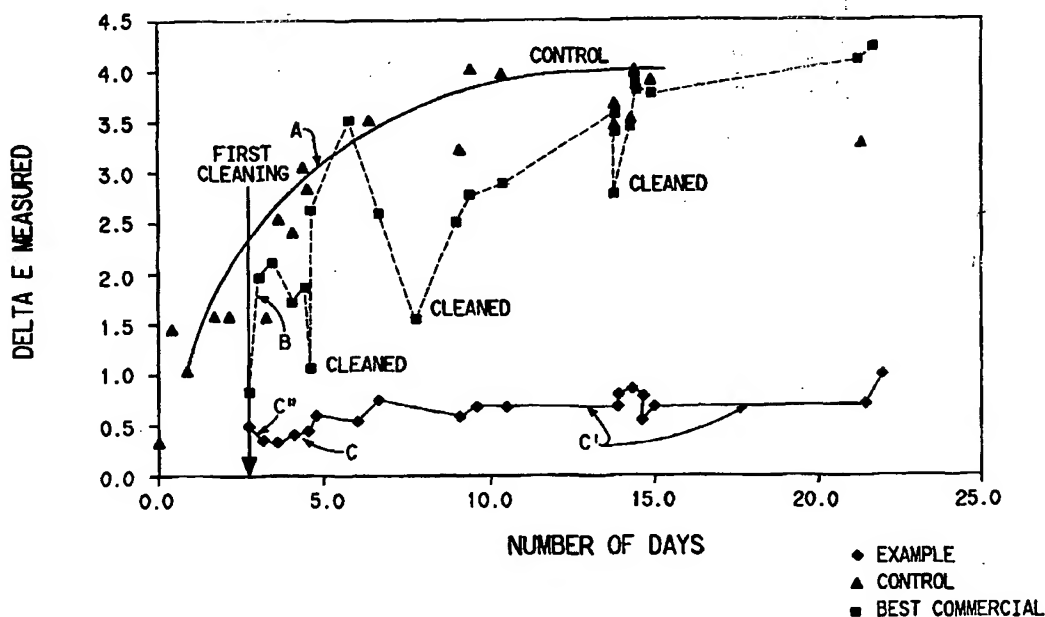
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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>6</sup> : <b>C11D 3/00, 1/00</b>		A2	(11) International Publication Number: <b>WO 98/18892</b>
			(43) International Publication Date: 7 May 1998 (07.05.98)
(21) International Application Number: PCT/US97/17583			(81) Designated States: AU, BR, CA, JP, MX, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).
(22) International Filing Date: 29 September 1997 (29.09.97)			
(30) Priority Data: 08/738,154 25 October 1996 (25.10.96) US			
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(54) Title: CLEANING FORMULATION FOR FABRICATED YARN PRODUCTS



(57) Abstract

A cleaning formulation for a fabricated yarn product such as a carpet comprises: a styrene maleic anhydride polymer stain resist agent; an anionic surfactant; a mixed alkyl ethoxylated (C10-C16) nonionic surfactant having a hydrophile lipophile balance in the range of about 10.5 to about fifteen; and a fluorosurfactant. A fluorochemical soil resist agent may be optionally included. The cleaning formulation may be made in dilute or concentrate form.

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## TITLE

CLEANING FORMULATION FOR FABRICATED YARN PRODUCTS5                   Background of the InventionField of the Invention

          This invention relates to a cleaning  
formulation particularly useful in the cleaning of a  
10   fabricated yarn product (such as used in upholstery,  
drapery, textiles, rugs or carpets) using any cleaning  
method that which leaves at least part or all of the  
cleaning formulation on the fabricated yarn product  
being cleaned.

15

Description of the Prior Art

          The cleaning formulation of the present  
invention is herein described in terms of the cleaning  
of "carpet", although, as noted above, it has  
20   applicability to the cleaning of any fabricated yarn  
product.

          The removal of soil from carpet, especially  
carpet located in high traffic areas, is a recurring  
maintenance problem. Unless a deep cleaning procedure,  
25   such as hot water extraction, is used, complete removal  
of soil from the carpet is not accomplished. However,  
deep cleaning procedures are expensive and time  
consuming. Instead it is common practice to utilize  
other cleaning procedures, such as bonnet cleaning, as  
30   an interim maintenance procedure to clean carpet  
between the performance of deeper cleaning processes.

          Bonnet cleaning is a process wherein a cleaning  
formulation is first applied to a carpet and then the  
carpet is brushed or buffed with an absorbent pad  
35   rotated on the carpet using a rotary floor machine.  
In bonnet cleaning both soil and cleaning formulation  
are partially absorbed by the pad. The carpet is left  
drier than when cleaned using a deeper cleaning

procedure, such as hot water extraction. However, the bonnet cleaning process usually does not clean as thoroughly as hot water extraction. Although the surface of a bonnet cleaned carpet appears clean, most  
5 of the soil is still left in the carpet. Moreover, since bonnet cleaning does not include a rinsing step, a significant level of residue from the cleaning formulation is left on the carpet. Cleaning formulation residue actually attracts dirt so that a  
10 cleaned carpet may resoil much faster than a new carpet. Quite frequently the carpet will appear clean after the interim procedure, but resoiling will occur rapidly, often significantly more rapidly than with carpet cleaned by hot water extraction.

15 In view of the foregoing it is believed to be advantageous to provide a cleaning formulation that permits an interim cleaning method, such as bonnet cleaning, to approach the degree of cleaning possible with a deeper cleaning procedure, such as hot water  
20 extraction cleaning. Moreover, it is believed to be of further advantage to provide a cleaning formulation which not only cleans better than current formulations and processes, but also which make the carpet fibers soil-resistant so that resoiling of the cleaned carpet  
25 is not promoted.

#### Summary of the Invention

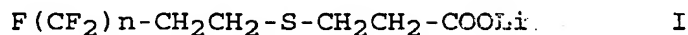
The present invention is directed to an  
30 aqueous cleaning formulation comprising:

- a) about three (3) to about seventy (70) grams, and more preferably about ten (10) to about sixty (60) grams, of a styrene maleic anhydride polymer stain resist agent, per gallon of cleaning formulation;
- 35 b) about three (3) to about fifty (50) grams, and more preferably, about five (5) to about thirty (30) grams, of an anionic surfactant, per gallon of cleaning formulation;

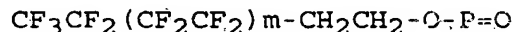
c) about three (3) to about fifty (50) grams, and more preferably, about five (5) to about twenty-five (25) grams, of a mixed alkyl ethoxylated (C10-C16) nonionic surfactant having a hydrophile lipophile balance in the range of about 10.5 to about fifteen (15), per gallon of cleaning formulation, and

d) about one-half (0.5) to about fifty (50) grams, and more preferably about one (1) to about five (5) grams, of fluorosurfactant, per gallon of cleaning formulation.

A suitable anionic surfactant is sodium lauryl sulfate. A suitable fluorosurfactant may be a compound selected from the group consisting of compounds of Formula I, compounds of Formula II, or mixtures thereof, where Formula I and Formula II are:



20



II

25

wherein n is an integer having a value of six (6) to twelve (12), and

m is an integer having a value of two (2) to five (5).

30

The cleaning formulation of the present invention may optionally further comprise about one (1) to about two-hundred (200) grams, and more preferably about five (5) to about seventy (70) grams, of a soil resist agent, per gallon of cleaning formulation. A suitable soil resist agent is a fluorochemical.

35

In another aspect the invention may be implemented in a concentrate form for making an aqueous

cleaning formulation having the concentration ranges as set forth above.

#### Brief Description of the Drawings

5           Figure 1 is a representation of the performance of carpet sections cleaned using different cleaning formulations as described in the field trial test of Example 5.

#### 10           Detailed Description of the Invention

          This invention is directed to a cleaning formulation which, although described herein terms of the cleaning of "carpet", has applicability to the  
15   cleaning of any fabricated yarn product as used in upholstery, drapery, textiles, rugs or carpets.

          The cleaning formulation when used in a cleaning process improves the cleaning efficiency of the process and does not promote resoiling or  
20   restaining of the cleaned carpet. By "resoiling" it is meant the tendency of a cleaned carpet to attract dirt because of shampoo residue left on the carpet after cleaning. Similarly "restaining" is the tendency of a  
25   cleaned carpet to attract stains which may be caused in part because of shampoo residue on the carpet.

          The cleaning formulation of the present invention may be made in either a dilute or concentrate form. The cleaning formulation of the present  
30   invention contains no glycol, alcohol or other organic solvents normally found in cleaning solutions. The use of these solvents leads to accelerated soiling caused by the residue remaining after cleaning with solutions.

          The aqueous cleaning formulation of this invention comprises:

- 35           a) a styrene maleic anhydride polymer stain resist agent;  
          b) an aqueous solution of an anionic surfactant;

c) a mixed alkyl ethoxylated (C10-C16) nonionic surfactant having a hydrophile lipophile balance ("HLB") in the range of about 10.5 to about fifteen (15); and

5 d) a fluorosurfactant.

Stain resist agent By "stain resist agent" it is meant chemicals which impart partial or total resistance to staining. Staining is here defined as the color change of a fabricated yarn product that exhibits resistance to removal by standard cleaning methods. Stain resist agents may include compounds such as hydrolyzed maleic anhydride co- or terpolymers with aliphatic alpha olefins, aromatic olefins or vinyl ethers, and homo- or copolymers of methacrylic acid. Suitable for use as the styrene maleic anhydride polymer stain resist agent is the agent sold by E. I. du Pont de Nemours and Company, ("DuPont"), Wilmington, Delaware, under the trademark ZELAN<sup>®</sup> 338.

Anionic surfactant Preferred for use as the anionic surfactant is an aqueous solution of sodium lauryl sulfate, such as DUPONOL<sup>®</sup> WAQE, (Witco Chemical Co., Baltimore, MD.) Many other anionic surfactants may also be used.

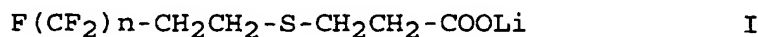
Nonionic surfactant Preferred for use as the nonionic surfactant is the mixed alkyl ethoxylate (C10-C16) nonionic surfactant MERPOL<sup>®</sup> SH (DuPont Co., Wilmington, DE).

The choice of nonionic surfactant is critical to the efficacy of the cleaning formulation. Nonionic surfactants having hydrophile lipophile balance ("HLB") values outside of the range of about 10.5 to about fifteen (15) either do not clean as well as those having HLB values within that range or their residues left on the carpet attract dirt (worsen resoiling) more than nonionic surfactants having HLB values within that range.

Fluorosurfactant Suitable fluorosurfactants include, but are not limited to, for example, those

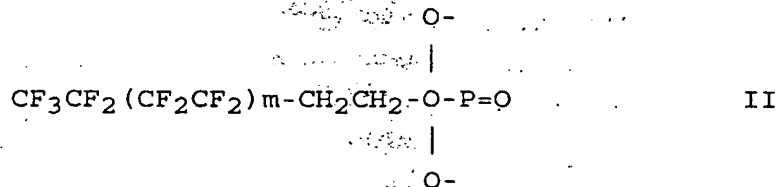
compounds commercially available from DuPont and 3M. Mixtures of fluorosurfactants may also be used. A fluorosurfactant compound of Formula I or Formula II, or suitable mixtures thereof, may be used. Formula I is:

5



wherein n is an integer having a value of 6 to 12 and may be identified as an  $\alpha$ -{2-[(2-carboxyethyl)thio]ethyl}- $\Omega$ -fluoro-poly-(difluoromethylene) lithium salt, and Formula II is a ammonium salt of a perfluoroalkyl phosphate as represented by the general formula:

15



20

wherein m is an integer having a value of 2 to 5. The weight ratio of Formula I to the perfluoroalkyl phosphate of Formula II in the mixture is in the range of from about 1:1 to about 1:2, and the amount of the mixture employed in the composition is from about 0.025% to about 0.17% by weight, more preferably from about 0.1% to about 0.15% by weight, most preferably about 0.1% by weight, where the percentages expressed are percent active ingredient. The compound of Formula I is available as ZONYL<sup>®</sup> FSA, compound of Formula II is available as ZONYL<sup>®</sup> FSP, and a mixture compound is available as ZONYL<sup>®</sup> 7950, all from DuPont.

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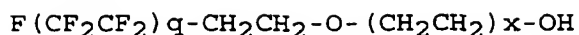
Other suitable fluorosurfactants include the compounds of Formula III and IV, wherein Formula III is:

35



wherein p is an integer having a value of 3 to 6, and wherein Formula IV is:





IV

wherein q is an integer having a value of 3 to 6, y is  
5 an integer having a value of less than 20, and x is an  
integer having a value of less than y.

The compound of Formula III is available from  
DuPont as ZONYL<sup>®</sup> FSN and the compound of Formula IV is  
available from DuPont as ZONYL<sup>®</sup> FSO. Fluorosurfactants  
10 available from 3M may also be used, including but not  
limited to FLORAD products designated as FC-93, FC-100,  
FC-120, FC-129 and FC-117.

Fluorochemical soil resist By "fluorochemical  
soil resist" is meant a composition which resists or  
15 repels dirt, oil, or other substances not normally  
intended to be present on a substrate such as a  
fabricated yarn product. Fluorochemical soil resist  
agents may include polymers or compounds having pendent  
or end groups of perfluoroalkyl moieties,  
20 fluorosurfactants, or fluoro-intermediates. Suitable  
fluorochemical soil resist agents are available from  
many suppliers including 3M and DuPont, for example,  
ZONYL<sup>®</sup> 5180 (available from DuPont).

Depending on the actual ingredients used in the  
25 cleaning formulation, the useful concentrations of each  
ingredient will vary. One skilled in the art could  
rapidly determine both the useful concentration range  
and optimum concentration for each ingredient used in  
the cleaning formulations of this invention.

30 One preferred formulation comprises: (a) about  
three (3) to about seventy (70) grams of styrene maleic  
anhydride polymer per gallon of cleaning formulation;  
(b) about three (3) to about fifty (50) grams aqueous  
solution of sodium lauryl sulfate per gallon of  
35 cleaning formulation; (c) about three (3) to about  
fifty (50) grams mixed alkyl ethoxylated (C10-C16)  
nonionic surfactant having a hydrophile lipophile  
balance ("HLB") in the range of about 10.5 to about

fifteen (15) per gallon of cleaning formulation; and  
(d) about one-half (0.5) to about fifty (50) grams of a  
fluorosurfactant mixture per gallon of cleaning  
formulation.

5           In a more preferred instance the concentration  
of styrene maleic anhydride polymer stain resist is  
about ten (10) to about sixty (60) grams per gallon of  
cleaning formulation; the concentration of anionic  
surfactant is about five (5) to about thirty (30) grams  
10 per gallon of cleaning formulation; the concentration of  
mixed alkyl ethoxylated (C10-C16) nonionic surfactant is  
about five (5) to about twenty-five (25) grams per  
gallon of cleaning formulation; and the concentration of  
fluorosurfactant is about one (1) to about five (5)  
15 grams per gallon of cleaning formulation.

          The cleaning formulation may optionally further  
include about one (1) to about two-hundred (200) grams,  
and more preferably about five (1) to about seventy  
(70) grams, of a fluorochemical soil resist agent per  
20 gallon of cleaning formulation.

          It is to be noted that amounts of ingredients  
expressed in this application (including the claims) in  
terms of "grams", "per gallon of cleaning formulation"  
are to be understood as referring to the weight in  
25 grams of a given active ingredient per gallon of  
cleaning formulation.

Concentrate Oftentimes it is convenient to  
dilute a concentrate to achieve these cleaning solution  
formulations. The invention should be construed to  
30 encompass a concentrate suitable for making an aqueous  
cleaning formulation, the concentrate comprising: (a)  
styrene maleic anhydride polymer; (b) an anionic  
surfactant; (c) mixed alkyl ethoxylated (C10-C16)  
nonionic surfactant; (d) a fluorosurfactant; and,  
35 optionally, (e) fluorochemical soil resist agent,  
whereby the concentrate is capable of being diluted  
with an appropriate amount of water to produce an  
aqueous cleaning formulation having concentrations

expressed as grams of active ingredient per gallon of solution of (a) about three (3) to about seventy (70) grams of a styrene maleic anhydride polymer stain resist agent per gallon of cleaning formulation; (b) 5 about three (3) to about fifty (50) grams of an aqueous solution of an anionic surfactant per gallon of cleaning formulation; (c) about three (3) to about fifty (50) grams mixed alkyl ethoxylated (C10-C16) nonionic surfactant having a hydrophile lipophile 10 balance in the range of about 10.5 to about fifteen (15) per gallon of cleaning formulation; (d) about one-half (0.5) to about fifty (50) grams of fluorosurfactant per gallon of cleaning formulation; and (e) (if used) about one (1) to about two-hundred 15 (200) grams of soil resist agent per gallon of cleaning formulation.

In a more preferred instance the cleaning concentrate is also capable of being diluted with an appropriate amount of water to produce an aqueous 20 cleaning formulation having a concentration of about ten (3) to sixty (60) grams of a styrene maleic anhydride polymer stain resist agent per gallon of cleaning formulation, about five (5) to about thirty (30) grams of anionic surfactant per gallon of cleaning 25 formulation, five (5) to twenty-five (25) grams of a mixed alkyl ethoxylated (C10-C16) nonionic surfactant per gallon of cleaning formulation, about five (5) to about seventy (70) grams of fluorosurfactant per gallon of cleaning formulation; and (e) (if used) about five 30 (5) to about seventy (70) grams of soil resist agent per gallon of cleaning formulation.

Other ingredients As an optional ingredient, citric acid can be used to stabilize these formulations. Other chemical agents, such as 35 fragrances, softeners, buffers, foaming agents and brighteners may be added to the composition to obtain special effects on the cleaned carpet fiber.

Methods of application It is to be understood that the cleaning formulation of the present invention is not limited to use in the bonnet cleaning method, but is applicable to any method that involves the

5 application of a cleaning formulation to a fabricated yarn product either before or during the application of some form of mechanical action which allows agitation of the cleaning formulation onto and into the fibers of the carpet, optionally followed by partial removal of

10 the cleaning formulation. Such common cleaning methods include, but are not limited to, hot water extraction, rotary brush cleaning, bonnet, and rotary dry foam cleaning. The cleaning formulation can be applied in any convenient manner, such as foaming, rolling or

15 spraying, using a pad, brush or any other convenient appliance.

**TEST METHODS****MEASUREMENT OF COLOR DIFFERENCE ( $\Delta E$ )**

A Minolta CR-100 Chroma Meter was used to  
5 measure  $\Delta E$  of the carpets both before and after  
cleaning.  $\Delta E$  is a measure of cleanliness since dirty  
carpets appear dark and they lighten on cleaning. The  
standards used for calculating  $\Delta E$  were measured on new,  
unused carpet samples or dirty, used carpet samples,  
10 depending on which the Example uses as the starting  
point, i.e., whether the Example is looking at cleaning  
or resoiling performance. See each Example for which  
standard was used for that example.  $\Delta E$  must always be  
interpreted relative to the standard or starting point.  
15 Color readings were taken at three different areas on  
the carpet sample and the average  $\Delta E$  was reported. In  
measuring the  $\Delta E$ , the standard values to be used for  
calculating  $\Delta E$  of either new, unused carpet samples or  
dirty, used carpet samples are first measured, and this  
20 value is stored in the memory of the Chroma Meter. The  
value of the carpet after soiling or cleaning is then  
measured by the Chroma Meter, and the  $\Delta E$  is calculated  
therefrom.  $\Delta E$  color deviation represents the total  
color difference. When using new carpet as the  
25 standard, a lower  $\Delta E$  value is desirable, meaning the  
carpet resisted resoiling better than a carpet with a  
higher  $\Delta E$  value. When using dirty carpet as the  
standard, a higher  $\Delta E$  is desirable, indicating that the  
carpet became lighter and thus cleaner than a carpet  
30 sample with a lower  $\Delta E$  which had the same initial color  
value before cleaning.

EXAMPLESExamples 1-4

These Examples demonstrate the cleaning and  
resoil characteristics of the cleaning formulations of  
5 this invention. A light gray nylon 6 loop pile 1/10  
gauge, 26 oz. carpet sample was used. The carpet was  
heavily soiled carpet which had been removed from  
commercial use. Results are in Table I.

Cleaning Efficiency - The machine used to simulate  
10 the bonnet machine was a commercially available  
apparatus fitted with 6 inch circular polyester bonnet  
pads. The apparatus was controlled by a variable speed  
switch so that the pad rotated at about 300 rpm.  
Pressure was applied to the pad in such a way that the  
15 motor of the drill did not significantly slow.

The cleaning procedure was to:

- a) Pre-vacuum the dirty carpet thoroughly to  
remove loose soil;
- b) Measure the standard, or starting point  
20 value, with the Chroma Meter;
- c) Spray about 5 grams of the cleaning  
formulation on the carpet section to be tested. The  
section was approximately 6 inches wide by 12 inches  
long;
- 25 d) Spray the bonnet pad with 1 gram cleaning  
solution;
- e) Run the hand bonnet machine over the piece  
of carpet for 10 seconds moving the pad back and forth  
across the treated area;
- 30 f) Let the carpet dry and measure the  $\Delta E$   
value relative to the standard measured in step (b).

The  $\Delta E$  for the dirty vs. the clean carpet was  
a measure of the cleaning ability of the formulation.  
35 Again, when determining cleaning performance, higher  
 $\Delta E$ 's are desirable.

Resoil Resistance - The ability of a cleaned carpet to resist resoiling was determined by an accelerated soiling test wherein a cleaned carpet was exposed to a controlled amount of soil for a specified time, vacuumed to remove loose soil and the  $\Delta E$  measured. The reference standard used for  $\Delta E$  calculation was the cleaned carpet prior to soiling. When determining resoil resistance, lower  $\Delta E$ 's are desirable.

The equipment used in the resoil test includes a ball mill having a drum 10.5 inches deep, 40 inches in circumference and dirty polymer pellets (used to introduce a controlled amount of soil). The dirty polymer pellets were prepared by adding 3g of synthetic soil to 1000g of nylon polymer pellets and mixing in the ball mill for 10 minutes at 30 rpm. The synthetic soil was prepared according to AATCC Test Method 123-1989 and contained (percentages are by weight): 38% dark peat moss, 17% portland cement, 17% kaolin clay, 17% silica (200 mesh), 1.75% carbon black (furnace or lamp black), 0.5% red iron oxide and 8.75% mineral oil (medicinal grade).

Carpets were soiled by mounting them in the clean drum, taping with double-sided tape at the seams. 500g of soiled polymer pellets were then added along with cylindrical grinding stones (12 x 67.5g stones and 200 4.5g stones). The mill was run at 30 rpm for 30 minutes. Carpets were removed, vacuumed to remove loose dirt and the  $\Delta E$  measured relative to the reference standard as measured, above.

The following concentrations were used:

<u>WEIGHT PERCENT</u>		
<u>ACTIVE INGREDIENT</u>		
styrene maleic anhydride	ZELAN <sup>®</sup> 338	40
anionic surfactant	DUPONOL WAQE	40
nonionic surfactant	MERPOL <sup>®</sup> SH	50
fluorosurfactant	ZONYL <sup>®</sup> 7950	40
soil resist agent	ZONYL <sup>®</sup> 5180	18

Note: The weights (\*) given in Table I are in grams of solution per gram of cleaning formulation. To obtain the grams of active ingredient per gram of cleaning formulation, multiply the appropriate weight percent of each active ingredient by the weight listed in Table I.

TABLE I

EXAMPLE	CLEANING FORMULATION*	$\Delta E$ CLEANING	$\Delta E$ RESOIL
1	28.4 G/GAL ZELAN <sup>®</sup> 338	2.51	6.91
10	28.4 G/GAL DUPONOL WAQE		
	11.8 G/GAL MERPOL <sup>®</sup> SH		
	7.1 G/GAL ZONYL <sup>®</sup> 7950		
2	84.1 G/GAL ZELAN <sup>®</sup> 338	0.67	16.8
15	42.0 G/GAL DUPONOL WAQE		
	63.1 G/GAL MERPOL <sup>®</sup> SH		
	21.0 G/GAL ZONYL <sup>®</sup> 7950		
3	28.4 G/GAL ZELAN <sup>®</sup> 338	3.01	4.92
20	28.4 G/GAL DUPONOL WAQE		
	11.8 G/GAL MERPOL <sup>®</sup> SH		
	7.1 G/GAL ZONYL <sup>®</sup> 7950		
	108.8 G/GAL ZONYL <sup>®</sup> 5180		
25	25.2 G/GAL ZELAN <sup>®</sup> 338	3.11	9.98
	12.6 G/GAL DUPONOL WAQE		
	31.5 G/GAL MERPOL <sup>®</sup> SH		
	6.3 G/GAL ZONYL <sup>®</sup> 7950		
	109.3 G/GAL ZONYL <sup>®</sup> 5180		

30

All the test formulations cleaned satisfactorily. For resoiling, the lower the  $\Delta E$ , the better. Formulation No. 3 had the best overall performance, based on cleaning and resoil resistance. Examples 3 and 4 demonstrate the effect of ZONYL<sup>®</sup> 5180 which appears to improve both cleaning efficiency and resoil resistance.



Example 5

This Example demonstrates under real field conditions the ability of the cleaning formulations of the present invention to clean the carpet and to  
5 prevent resoiling.

The equipment used was a standard bonnet cleaner with polyester pads. The cleaning formulations being tested were sprayed onto the carpet using a hand sprayer and ten (10) grams solution was applied to each  
10 square foot of carpet.

To determine the best commercial carpet cleaning formulation, seven commercial products were evaluated by cleaning a dirty carpet sample with each product and measuring the  $\Delta E$  after allowing the carpet to dry. The  
15 best cleaning product was determined to be the one with the highest  $\Delta E$ . This will be designated hereafter as formulation "BC" (i. e., "best commercial").

The carpet used was 1/10 gauge, 29 oz. loop pile carpet made using smoke beige Lumena<sup>®</sup> nylon 6,6  
20 face fiber. The standard used to calculate  $\Delta E$  on the Chroma Meter was new, unused carpet. The carpet was left in a high traffic corridor for 28 days, and exposed to approximately 4000 traffics/day. Each traffic represents one person walking across the  
25 carpet. The carpet was divided into three sections which experienced equivalent traffic. All three sections were vacuumed well each night.

The "CONTROL" section was never cleaned. The "COMPARISON" section was cleaned as needed with  
30 cleaning formulation BC, determined as described above to be the best commercially available interim carpet cleaner. The "EXAMPLE" section was cleaned as needed with the cleaning formulation according to the present invention. The carpet of the COMPARISON section and  
35 the EXAMPLE section were first cleaned when  $\Delta E$  exceeded 1.5 units, based on clean carpet as the standard. Upon resoiling, if the change in  $\Delta E$  exceeded about 1 to 1.5 units above the previously cleaned  $\Delta E$  value, it was

deemed that cleaning was needed and the carpet cleaned again. The formulation according to the invention which was used, expressed in grams of active ingredient per gallon of cleaning solution, comprised: (a)

- 5 11 grams ZELAN<sup>®</sup> 338 (available from DuPont); (b) 14 grams DUPONOL WAQE (available from Witco Chemical Co.); (c) 12 grams MERPOL<sup>®</sup> SH (available from DuPont); (d) 3 grams fluorosurfactant; and (e) 42 grams ZONYL<sup>®</sup> 5180 soil resist agent (available from DuPont).

TABLE II

	<u>DAY</u>	<u>CONTROL</u>	<u>EXAMPLE</u>	<u>COMPARISON</u>
10	0.3	0.56		
	1.0	1.0		
	1.3	1.1		
15	2.0	1.5		
	2.5	1.1		
	3.0	1.4		
	3.2		0.5	0.8
	3.5	1.4	0.3	2.0
20	4.0	1.6	0.3	2.1
	4.4	1.65	0.4	1.7
	5.0	1.7	0.4	1.9
	5.2		0.4	1.06
	5.6	1.7	0.6	2.6
25	6.4	1.4	0.5	3.5
	8.5	1.8	0.75	2.6
	9.0			1.6
	9.4	2.0	0.6	2.5
	9.6	2.0	0.55	2.26
30	10.0	2.25	0.7	2.8
	11.0	2.44	0.7	2.9
	14	2.5	0.7	3.6
	14			2.7
	15	2.6	0.8	3.8
35	21.1	3.0	1.1	3.5

The results of this field trial are listed in Table II above and are graphically represented in Figure 1.

5           Figure 1 represents the results of the field trial. The diamond symbols on the Figure represent  $\Delta E$  measured for the "CONTROL" section, the square symbols represent the "COMPARISON" section (cleaned as needed with cleaning formulation BC), while the diamond  
10           symbols represent the "EXAMPLE" section cleaned with the cleaning formulation according to the invention.

          Amazingly, the carpet sample of the EXAMPLE section did not require cleaning for twenty-one days following the date of "First Cleaning" with the  
15           formulation of the invention. The COMPARISON section was cleaned three times in that interval.

          The resoiling of the carpet sections was also markedly impacted. Following cleaning with Formulation BC the COMPARISON section of the carpet appeared to soil  
20           more rapidly than the CONTROL carpet section (which was not cleaned but only vacuumed routinely). The rate of resoiling is proportional to the slope of the curves in Figure 1. The CONTROL and COMPARISON sections soiled or  
25           resoiled, respectively, rapidly (as indicated by the relative steepness of the slopes of the curves in the regions "A" and "B" of Figure 1) as compared to the rate of resoiling of the EXAMPLE section with respect to the  
30           slope of the curve (marked by the reference character "C" in Figure 1).

30           Moreover, following cleaning with the formulation of the invention the EXAMPLE carpet section did not appear to resoil at all, as evidenced by the relatively flat slope of the curve over the entire  
35           duration of the test period, as indicated by the character C' in Figure 1.

          Further, as indicated by the character C" in Figure 1, initially the EXAMPLE section even appeared to get cleaner after subsequent vacuuming.

In one specific instance, after a water spill, a dirty spot was observed to develop on the EXAMPLE section after having been cleaned with the formulation of the invention. After about a day, when the carpet had dried, the spot disappeared with routine vacuuming without any further cleaning. It is thought that the formulation of the invention which remained on the carpet after cleaning dried and encapsulated the dirt which was then more easily removed by vacuuming.

What is Claimed is:

1. An aqueous cleaning formulation comprising:

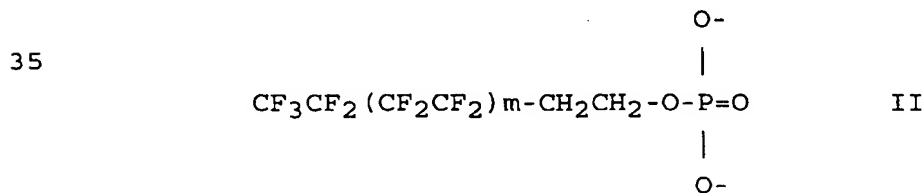
- a) about three (3) to about seventy (70)  
 5 grams of a styrene maleic anhydride polymer stain  
 resist agent per gallon of cleaning formulation,  
 b) about three (3) to about fifty (50)  
 grams of an aqueous solution of an anionic surfactant  
 per gallon of cleaning formulation,  
 10 c) about three (3) to about fifty (50)  
 grams of a mixed alkyl ethoxylated (C10-C16) nonionic  
 surfactant having a hydrophile lipophile balance in the  
 range of about 10.5 to about fifteen (15) per gallon of  
 cleaning formulation, and  
 15 d) about one-half (0.5) to about fifty  
 (50) grams of fluorosurfactant per gallon of cleaning  
 formulation.

2. The aqueous cleaning formulation of Claim  
 20 1, further comprising about one (1) to about two-  
 hundred (200) grams of a soil resist agent per gallon  
 of cleaning formulation.

3. The aqueous cleaning formulation of Claim  
 25 2, wherein the soil resist agent is a fluorochemical.

4. The aqueous cleaning formulation of Claim  
 1 wherein the fluorosurfactant is a compound selected  
 from the group consisting of compounds of Formula I,  
 30 compounds of Formula II, or mixtures thereof,

where Formula I and Formula are:



wherein n is an integer having a value of 6 to 12, and m is an integer having a value of 2 to 5.

5. The aqueous cleaning formulation of Claim 1 wherein the concentration of styrene maleic anhydride polymer is about ten (10) to about sixty (60) grams per gallon of the cleaning formulation, the concentration of anionic surfactant is about five (5) to about thirty (30) grams per gallon of the cleaning formulation, the concentration of mixed alkyl ethoxylated nonionic surfactant is about five (5) to about twenty-five (25) grams per gallon of cleaning formulation, the concentration of fluorosurfactant is about one (1) to about five (5) grams per gallon of cleaning formulation.

6. The aqueous cleaning formulation of Claim 2 wherein the concentration of soil resist agent is about five (5) to about seventy (70) grams per gallon of cleaning formulation.

7. The aqueous cleaning formulation of Claim 1 wherein the anionic surfactant is sodium lauryl sulfate.

25

8. A cleaning concentrate for making an aqueous cleaning formulation, comprising:

(a) a styrene maleic anhydride polymer stain resist agent; (b) an anionic surfactant; (c) a mixed alkyl ethoxylated (C10-C16) nonionic surfactant having a hydrophile lipophile balance in the range of 10.5 to fifteen (15); and (d) a fluorosurfactant, whereby the concentrate is capable of being diluted with an appropriate amount of water to produce an aqueous cleaning formulation having a concentration of about three (3) to about seventy (70) grams of a styrene maleic anhydride polymer stain resist agent per gallon of cleaning formulation, about three (3) to

about fifty (50) grams of an aqueous solution of an anionic surfactant per gallon of cleaning formulation, about three (3) to about fifty (50) grams of a mixed alkyl ethoxylated (C10-C16) nonionic surfactant having  
5 a hydrophile lipophile balance in the range of about 10.5 to about fifteen (15) per gallon of cleaning formulation, and about one-half (0.5) to about fifty (50) grams of fluorosurfactant per gallon of cleaning formulation.

10

9. The cleaning concentrate of claim 8, whereby the concentrate is capable of being diluted with an appropriate amount of water to produce an aqueous cleaning formulation having a concentration of  
15 about ten (3) to sixty (60) grams of a styrene maleic anhydride polymer stain resist agent per gallon of cleaning formulation, about five (5) to about thirty (30) grams of anionic surfactant per gallon of cleaning formulation, five (5) to twenty-five (25) grams of a  
20 mixed alkyl ethoxylated (C10-C16) nonionic surfactant per gallon of cleaning formulation, about five (5) to about seventy (70) grams of fluorosurfactant per gallon of cleaning formulation.

25

10. The cleaning concentrate of Claim 9 wherein the concentrate further comprises a soil resist agent, whereby the concentrate is capable of being diluted with an appropriate amount of water to produce an aqueous cleaning formulation having a concentration  
30 of about five (5) to about seventy (70) grams of soil resist agent per gallon of cleaning formulation.

11. The cleaning concentrate of Claim 10 wherein the concentrate further comprises a soil resist  
35 agent, whereby the concentrate is capable of being diluted with an appropriate amount of water to produce an aqueous cleaning formulation having a concentration

of about one (1) to about two-hundred (200) grams of soil resist agent per gallon of cleaning formulation.

12. The cleaning concentrate of Claim 9  
5 wherein the anionic surfactant is sodium lauryl sulfate.

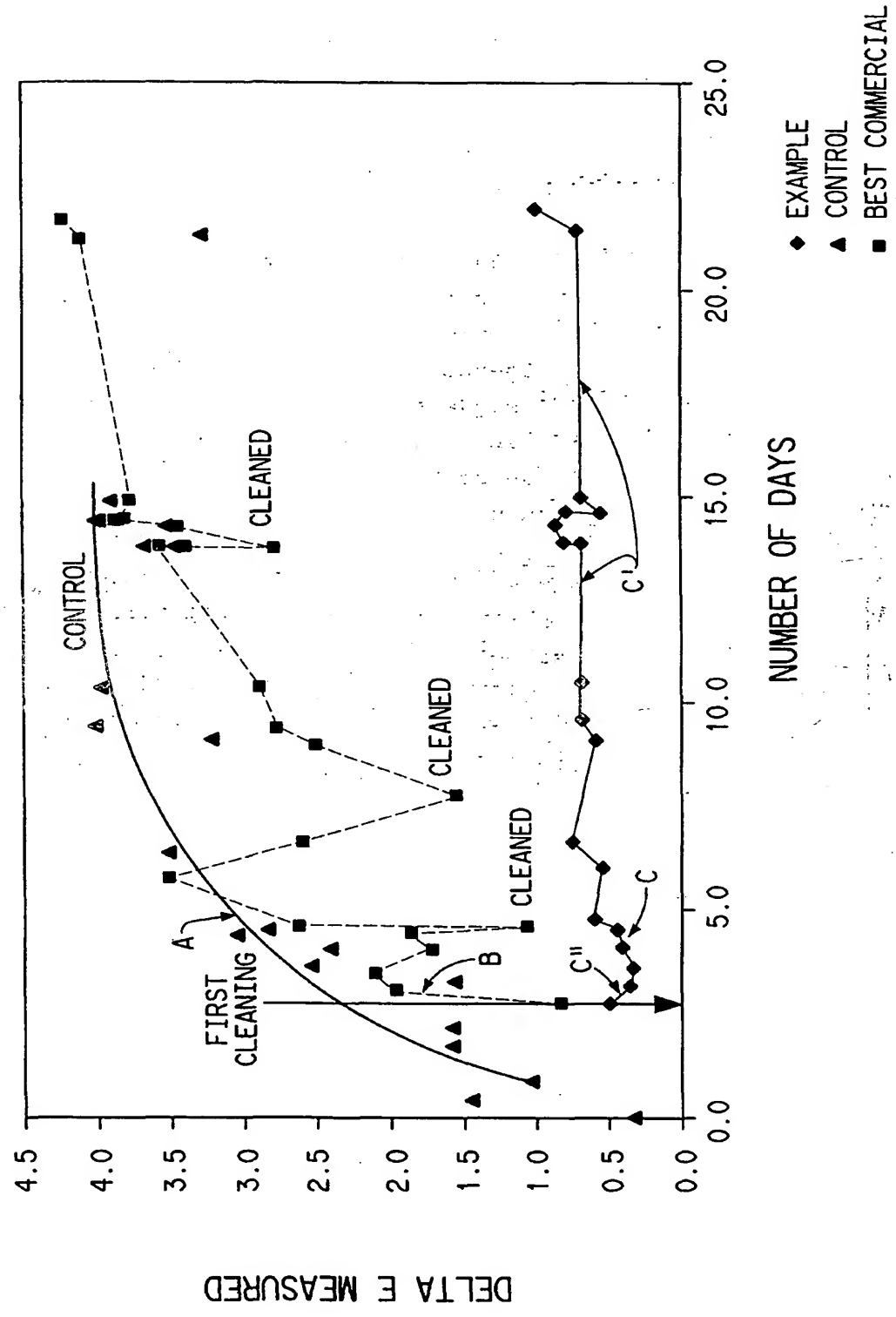
13. The cleaning concentrate of Claim 8  
wherein the anionic surfactant is sodium lauryl  
10 sulfate.

14. A method of using the aqueous cleaning  
formulation of Claim 1 to clean a fabricated yarn  
product comprising the steps of:  
15       applying the cleaning formulation of Claim 1  
to the surface of the fabricated yarn product; and  
agitating the cleaning formulation into the  
fabricated yarn product.

20       15. A method of using the aqueous cleaning  
formulation of Claim 2 to clean a fabricated yarn  
product comprising the steps of:  
applying the cleaning formulation of Claim 1  
to the surface of the fabricated yarn product; and  
25       agitating the cleaning formulation into the  
fabricated yarn product.



FIG. 1





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<b>(51) International Patent Classification <sup>6</sup> :</b> <b>C11D 3/37, 1/83</b>	<b>A3</b>	<b>(11) International Publication Number:</b> <b>WO 98/18892</b> <b>(43) International Publication Date:</b> 7 May 1998 (07.05.98)
<b>(21) International Application Number:</b> PCT/US97/17583 <b>(22) International Filing Date:</b> 29 September 1997 (29.09.97)  <b>(30) Priority Data:</b> 08/738,154      25 October 1996 (25.10.96)      US  <b>(71) Applicant:</b> E.I. DU PONT DE NEMOURS AND COMPANY [US/US]; 1007 Market Street, Wilmington, DE 19898 (US).  <b>(72) Inventor:</b> DEL PESCO, Thomas, Wayne; 344 Skyline Orchard Drive, Hockessin, DE 19707 (US).  <b>(74) Agent:</b> MEDWICK, George, M.; E.I. du Pont de Nemours and Company, Legal Patent Records Center, 1007 Market Street, Wilmington, DE 19898 (US).		<b>(81) Designated States:</b> AU, BR, CA, JP, MX, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).  <b>Published</b> <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>  <b>(88) Date of publication of the international search report:</b> 16 July 1998 (16.07.98)
<b>(54) Title:</b> CLEANING FORMULATION FOR FABRICATED YARN PRODUCTS  <b>(57) Abstract</b>  A cleaning formulation for a fabricated yarn product such as a carpet comprises: a styrene maleic anhydride polymer stain resist agent; an anionic surfactant; a mixed alkyl ethoxylated (C10-C16) nonionic surfactant having a hydrophile lipophile balance in the range of about 10.5 to about fifteen; and a fluorosurfactant. A fluorochemical soil resist agent may be optionally included. The cleaning formulation may be made in dilute or concentrate form.		

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# INTERNATIONAL SEARCH REPORT

International Application No

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## A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 C11D3/37 C11D1/83

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 C11D

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## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 648 834 A (EASTMAN KODAK COMPANY) 19 April 1995 see page 4 - page 6	1-15
A	WO 95 34631 A (S. C. JHONSON & SON, INC.) 21 December 1995 see abstract see examples see claims	1-3, 7, 8, 13-15
A	US 5 534 167 A (F. L. BILLMAN) 9 July 1996 see column 3, line 38 - line 54 see column 4, line 52 - column 7, line 34 see examples	1-3, 7, 8, 13-15

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category	Citation of document, with indication where appropriate, of the relevant passages	Relevant to claim No.
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